Stuff you should know for the final exam in Physics 315

Objectives covered for the maneuvering block

2-1 Understand why maneuvering is needed in aerial combat.
2-2 Know the four primary forces of aerodynamics.
2-3 Understand how lift, drag, thrust and weight are used for maneuvering in combat.
2-4 Know the definition of "G's" and how they affect aircraft performance.
2-5 Know how to read a V-n diagram.

3-1 Know how to calculate and what factors affect an aircraft's turn rate.
3-2 Know how to calculate and what factors affect an aircraft's turn radius.
3-3 Know the definition of corner velocity and how it affects an aircraft's combat performance.
3-4 Be able to compare an aircraft's turn performance in a level turn and a non-level turn.
3-5 Know the definitions of radial g and turn circle.

4-1 Understand how conservation of mechanical energy is related to aerial combat.
4-2 Know which of the four aerodynamic forces are non-conservative.
4-3 Understand what specific excess power is and how it is used in aerial combat.
4-4 Be able to interpret specific excess power overlays for a single aircraft and an aircraft comparison for combat.

5-1 Understand the three factors: range, aspect angle, and angle off (heading crossing angle), and how they relate to positional advantage.
5-2 Know the three types of pursuit curves and how they are used.
5-3 Understand what a High Yo-Yo is and when to use it during an aerial engagement.
5-4 Understand what a Low Yo-Yo is and when to use it during an aerial engagement.
5-5 Understand what a Lag roll is and when to use it during an aerial engagement.

6-2 Know when and how to properly separate.
6-4 Understand what Flat Scissors and Rolling Scissors are and when to use them during an aerial engagement.

7-2 Be able to compare an aircraft's performance in a level turn versus a vertical turn.

9-1 Understand what Lead Turns are.
9-2 Know the difference between a One-Circle Fight (Nose-to-Nose Turn) and a Two-Circle Fight (Nose-to-Tail Turn).

10-1 Understand what an angle fighter's primary tactics are and the physics principles used for this method of aerial combat.
10-2 Understand what an energy fighter's primary tactics are and the physics principles used for this method of aerial combat.

11-1 Understand the steps of a baseline intercept.
11-2 Know the definition of Collision Antenna Train Angle (CATA).
11-5 Know the basics of Radar Missile Defense (RMD) and Infrared Missile Defense (IRMD).

12-1 Be familiar with general types of surface-to air threats.
12-2 Know the advantages and disadvantages of low and medium altitude ingresses.
12-3 Understand the basic types of bomb deliveries and the advantages and disadvantages of each.

13-1 Understand the 6 factors that can cause manual bombing errors.

Objectives covered for the radar block

19-1 Know the definition of electronic warfare.
19-2 Know the primary portion of the electromagnetic spectrum used for aerial combat and how it's used.
19-3 Understand the basics of radar operations.
19-4 Know the basics components of a radar and how they work.

20-4 Know the definition of a decibel.
20-5 Understand how to use the decibel to show relative intensity.

21-1 Understand how phasors can be used to represent EM waves.
21-2 Understand how phasors are used to analyze complex EM waves.

22-1 Be able to describe several reasons why radars use certain frequencies.
22-2 Know the reason why radars have a main lobe and side lobes.
22-3 Know how a radar's beam width is defined.
22-4 Understand how angular resolution is determined.
22-5 Know the factors that degrade angular resolution.
22-6 Know the factors that enhance angular resolution.
22-7 Understand antenna gain.

23-1 Understand how a directional antenna produces a radiation pattern and what factors affect the shape of pattern.
23-2 Know how to determine the beamwidth of an antenna from its radiation pattern.

24-1 Be able to identify the different portions of a pulsed EM wave in the time domain.
24-2 Understand how noise and the power of the target's return effect maximum detection range.
24-3 Know what maximum unambiguous range is and what affects it.
24-4 Understand methods used to increase a radar's maximum unambiguous range.
24-5 Know how range resolution is determined and what factors enhance it.
24-6 Be able to determine a radar's resolution cell.

25-1 Understand the concept of "chirp".
25-2 Be able to calculate the range resolution of a chirped pulse.
25-3 Understand how range can be indirectly measured through linear FM modulation of the radar signal.
25-4 Be able to calculate target range using FM ranging techniques.

26-1 Understand what the Doppler effect is and what causes it.
26-3 Understand how phasors can be used to represent a Doppler shift in EM waves.
26-4 Be able to calculate the Doppler shift of a radar return.

27-1 Understand what coherent and incoherent pulses are.
27-2 Understand the purpose of a Fourier transform.
27-3 Know what is meant by a frequency spectrum.
27-4 Understand how pulse duration affects the pulsed spectrum.
27-5 Understand how the number of pulses affects the pulsed spectrum.
27-6 Understand how pulse repetition frequency affects the pulsed spectrum.

28-1 Understand the different ways a pulsed spectrum can be changed.
28-2 Understand how to minimize the line width and maximize the line spacing of a pulsed spectrum

30-1 Understand the purpose of Doppler filters and how they affect pulsed-Doppler radar performance.
30-2 Understand what is meant by dynamic range.
30-4 Understand what Doppler ambiguity is.
30-5 Understand the methods used to resolve Doppler ambiguities.
30-6 Understand the advantages and disadvantages of low and high PRFs.

31-1 Understand the factors that affect the ground clutter.
31-2 Understand ways to minimize ground clutter effects.
31-3 Understand effects of ground clutter on target radar returns.

Objectives covered for the applications block

32-1 Understand the physical processes in a phased array.
32-2 Understand how a phased-array antenna is steered electronically.
32-3 Know the cost and benefits of the phased array design.

33-1 Understand how the number of emitters affects the beam width and steering.
33-2 Understand how the emitter slit width affects the beam width and steering.
33-3 Understand how the emitter's phase shift affects the beam width and steering.

37-1 Know the definition of ESM
37-2 Know the main method used to accomplish ESM
37-3 Understand the physical processes used in interferometry.

38-1 Know the definition of ECM.
38-2 Know the three methods used to employ ECM.
38-3 Know the main types of jamming and how they affect a radar presentation.
38-4 Know the definition of ECCM.
38-5 Understand the methods used to counter noise and deception jamming.
38-6 Know the most effective ECCM of all.

39-1 Understand the resonance of an LC circuit.
39-2 Understand the basics of frequency modulation (FM).
39-3 Build a jammer that works.

40-1 Know the part of the EM spectrum used for IR threats.
40-2 Understand basic solid state band theory
40-3 Understand the different consideration used for seeker design.
40-4 Understand how an IRSTS is used, why they could be so effective, and their limitations
40-5 Know the different types of IRCM and how they are used.

41-1 Understand how stealth technology uses EM wave redirection.
41-2 Understand how stealth technology uses EM wave absorption.
41-3 Understand the basic principles of Low Probability of Intercept (LPI) technology.